

TRANSMITTAL FORM <i>(to be used for all correspondence after initial filing)</i>		Application No.	10/650,331	
		Filing Date	August 27, 2003	
		First Named Inventor	Clive Anthony Woodward	
		Art Unit		
Total Number of Pages in This Submission		6	Examiner Name	
		Attorney Docket Number	25821P036	

ENCLOSURES (check all that apply)		
<input checked="" type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Attached <input type="checkbox"/> Amendment / Response <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/declaration(s) <input type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Abandonment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> PTO/SB/08 <input checked="" type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Response to Missing Parts/Incomplete Application <input type="checkbox"/> Basic Filing Fee <input type="checkbox"/> Declaration/POA <input type="checkbox"/> Response to Missing Parts under 37 CFR 1.52 or 1.53	<input type="checkbox"/> Drawing(s) <input type="checkbox"/> Licensing-related Papers <input type="checkbox"/> Petition <input type="checkbox"/> Petition to Convert a Provisional Application <input type="checkbox"/> Power of Attorney, Revocation Change of Correspondence Address <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Request for Refund <input type="checkbox"/> CD, Number of CD(s) <div>Remarks</div>	<input type="checkbox"/> After Allowance Communication to Group <input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences <input type="checkbox"/> Appeal Communication to Group (Appeal Notice, Brief, Reply Brief) <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter <input checked="" type="checkbox"/> Other Enclosure(s) (please identify below): <div>REquest for Priority; return postcard</div>

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT	
Firm or Individual name	Eric S. Hyman, Reg. No. 30,139 BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP
Signature	
Date	3/8/04

CERTIFICATE OF MAILING/TRANSMISSION			
I hereby certify that this correspondence is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.			
Typed or printed name	Melissa Stead		
Signature		Date	3-5-04





FEE TRANSMITTAL for FY 2004

Effective 01/01/2004. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27.

TOTAL AMOUNT OF PAYMENT

(\$)

Complete if Known

Application Number 10/650,331
Filing Date August 27, 2003
First Named Inventor Clive Anthony Woodward
Examiner Name
Art Unit
Attorney Docket No. 25821P036

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☒ Deposit Account

Deposit Account Number

02-2666

Deposit Account Name

Blakely, Sokoloff, Taylor & Zafman LLP

The Commissioner is authorized to: (check all that apply)

- ☒ Charge fee(s) indicated below ☐ Credit any overpayments
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☐ Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account

FEE CALCULATION

1. BASIC FILING FEE

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee (\$)	Fee Code	Fee (\$)		
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	
SUBTOTAL (1)				(\$)	

2. EXTRA CLAIM FEES

Total Claims - 20 = X = Fee Paid
Independent Claims - 3 = X =
Multiple Dependent =

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee (\$)	Fee Code	Fee (\$)		
1202	18	2202	9	Claims in excess of 20	
1201	86	2201	43	Independent claims in excess of 3	
1203	290	2203	145	Multiple Dependent claim, if not paid	
1204	86	2204	43	**Reissue independent claims over original patent	
1205	18	2205	9	**Reissue claims in excess of 20 and over original patent	
SUBTOTAL (2)				(\$)	

**or number previously paid, if greater, For Reissues, see below

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee (\$)	Fee Code	Fee (\$)		
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet.	
2053	130	2053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for <i>ex parte</i> reexamination	
1804	920 *	1804	920 *	* Requesting publication of SIR prior to Examiner action	
1805	1,840 *	1805	1,840 *	* Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	1,210	2255	605	Extension for reply within fifth month	
1404	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	2451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	2460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	1809	385	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	
Other fee (specify)					

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3)

(\$)

SUBMITTED BY

Complete (if applicable)

Name (Print/Type) Eric S. Hyman
Registration No. (Attorney/Agent) 30,139
Telephone (310) 207-3800
Signature Date 3/7/04





DOCKET NO.: 25821P036

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

re the Application of:

CLIVE ANTHONY WOODWARD

Application No.: 10/650,331

Filed: August 27, 2003

For: flow meter

Art Group:

Examiner:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR PRIORITY

Applicant respectfully requests a convention priority for the above-captioned application, namely:

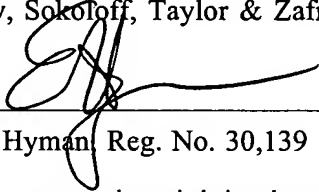
COUNTRY	APPLICATION NUMBER	DATE OF FILING
United Kingdom	0219965.1	28 August 2002

☒ A certified copy of the document is being submitted herewith.

Respectfully submitted,

Blakely, Sokoloff, Taylor & Zafman LLP

Dated: 3/8/04


Eric S. Hyman, Reg. No. 30,139

12400 Wilshire Boulevard, 7th Floor
Los Angeles, CA 90025
Telephone: (310) 207-3800

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Melissa Stead

3-9-04
Date



1000



INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed *AmBrewster*
Dated 1 September 2003



29AUG02 E744174-1 D10121
P01/7700 0.00-0219965.1

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

P16337

28 AUG 2002

2. Patent application number

(The Patent Office will fill in this part)

0219965.1

3. Full name, address and postcode of the or of each applicant (underline all surnames)

THAMES WATER UTILITIES LIMITED
GROUND WEST
CLEARWATER COURT,
VASTERN ROAD
READING, BERKSHIRE RG1 8DB

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

UNITED KINGDOM

14412862005

4. Title of the invention

FLOW METERS

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Edward Evans Barker
Clifford's Inn
Fetter Lane
London EC4A 1BZ

Patents ADP number (if you know it)

08199895001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description

5

Claim(s)

Abstract

Drawing(s)

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Date 28.08.02

Edmund Evans Baker

12. Name and daytime telephone number of person to contact in the United Kingdom

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- For details of the fee and ways to pay please contact the Patent Office.

FLOW METERS

The invention relates to a flow meter for monitoring flow of a fluid, particularly a liquid such as water, along a pipe, conduit or the like.

When a fluid flows in a pipe, head is generally lost due to friction between the fluid and the pipe wall. This loss of head is approximately proportional to the square of the flow rate. If the head at two points on the pipe can be measured with sufficient accuracy, the flow rate can be inferred. This is often difficult since head losses over short distances tend to be very small, limiting the utility of differential pressure measurements and measurement of head changes over large distances requires accurate knowledge of the relative elevations of the sensors.

It is also known that when a fluid in a pipe flows past any form of constriction, there is a step in the hydraulic gradient at the point of the constriction. The size of this step is also a function of the flow rate of the fluid, and many designs of flow meter have been produced which rely on measurement of differential pressure across a constriction of known characteristics such as an orifice plate or a venturi.

Moreover, any valve that can be set in a partly open condition can be used to generate a constriction that will generate a head loss which will be a function of both valve position and flow rate. This fact has been used by others who have made tapings on either side of valves that were not designed for this purpose, to allow differential pressure across the valve to be measured. An extensive calibration exercise is then required, using a reference flow meter, to establish relationships between differential pressure, flow rate and valve position for the fluid flowing through the valve. This known, the valve can be used as a flow meter.

It is an object of the invention to seek to mitigate these disadvantages.

According to the invention there is provided apparatus for monitoring flow of a fluid through a carrier such as a pipe, pipe-line, conduit or the like for the fluid, comprising a valve in the carrier and an electronic means for determining flow of fluid past the valve.



Preferably, the electronic means may be connected electronically with the valve so that the operation of the valve as a valve *per se* is not affected.

Thus, using the invention it is possible to provide a means of manufacturing a valve such that its subsequent use as a flow measuring device is simplified compared with existing practice.

According to another aspect of the present invention, there is provided a means of converting a valve for use as a flow meter, comprising:

- (a) Providing information regarding the optimal placement of tappings for differential pressure measurement;
- (b) Providing means of knowing the current position of the valve mechanism with sufficient accuracy to allow a desired flow measurement accuracy to be achieved; and
- (c) Providing calibration surface or a means of calculating the flow rate from the measured differential pressure and valve position information.

There may be modifications to the valve housing to simplify the attachment of a differential pressure measuring device. These modifications may be marking the optimal tapping locations on the valve housing, provision of a removable plug at each optimal tapping location, or provision of suitably positioned valves which in turn may be capable of accepting a push fit connector such that the valve is opened when the connector is in place, and automatically closes when the connector is removed.

Suitably there may be means for knowing the current position of the valve mechanism with sufficient accuracy to allow the desired flow measurement accuracy to be achieved.

There may preferably be a calibration surface or a means of calculating the flow rate from the measured differential pressure and valve position information, through or past the valve.

Again a means of converting the valve for use as a flow meter, may comprise one or more of the following:-



- (a) Provision of a differential pressure sensing element within the valve housing, arranged so as to be capable of measuring the differential pressure across the valve. This pressure sensing element may be provided with a means of being interrogated when required;
- (b) Provision of equipment capable of interrogating the differential pressure sensor and making the result available for use in flow calculation. This equipment may incorporate a means of calculating the flow rate, given information on the valve position and valve type;
- (c) A means of knowing the current position of the valve mechanism, with sufficient accuracy to allow the desired flow measurement accuracy to be achieved; and
- (d) A calibration surface or a means of calculating the flow rate from the measured differential pressure and valve position information.

In a preferred embodiment, apparatus including a valve is provided which has a primary function of restricting or preventing the flow of fluid through a pipe when required so to do (but not at other times), which has been adapted to facilitate the measurement of the differential pressure across a flow restricting element of the apparatus. The apparatus may also be adapted to improve the accuracy with which the position of the flow restricting element can be determined, and/or the apparatus may be adapted to improve or optimise flow characteristics of the fluid, suitably water, under restricted flow conditions and to optimise the differential pressure measurement system to facilitate the use of the differential pressure measurements in estimating the rate of fluid flow through the apparatus, which may be provided with calibration data to allow the flow rate of the fluid in question to be calculated from the differential pressure and flow restricting element position measurements.

The valve may comprise any kind of valve that is capable of partly restricting the flow of

fluid through it.

Whenever it is desirable to know the status of the valve, or to know the rate of fluid flow through the apparatus, it is possible to measure the differential pressure across the valve. If the position of the valve is known, and the relationship between differential pressure and flow rate is known for that position and for the relevant fluid, the flow rate and the direction of flow can be determined. If the position of the valve is such that the relationship between differential pressure and flow rate is not known (the restriction is too great or too small) the valve can be moved to a more suitable position.

In every embodiment, the differential pressure across the valve can serve as a guide to how fast the valve can be moved with safety. (As a general rule, the higher the differential pressure, the more slowly the valve must be moved. The actual safe rates of movement for any particular differential pressure are dependant on the length of pipe involved and the nature of the fluid contained therein. Where there is a need to restrict the rate of movement of a valve in order to eliminate the risk of harmful pressure surges, this feature of apparatus embodying the invention can be valuable).

Thus using the invention, it is possible to provide apparatus in which a valve is used to measure flow, i.e. to act as a flow meter, particularly when there may be cost or space constraints, preventing installation of a separate valve and flow meter, but more often, the reason is that a need has arisen to measure flow at a location where this need had not been foreseen at the design stage of an installation. Modification of an existing valve may be the most cost effective option but only if the valve is accessible and it is possible to fit a reference flow meter in line with the valve for calibration purposes.

There are many examples of situations where it would be advantageous to know the differential pressure across and the flow rate of water through a valve in a water distribution system,

Some of the benefits of knowing the rate of flow of water through a valve in a water distribution system are:

- If the rate of flow of water in a pipe is forced to change rapidly, a pressure surge is generated as the inertia of the water is increased or reduced. Where a large mass of water is involved (e.g. in long or large diameter pipes) the pressure surge can be very large and can lead to the danger of structural damage to the pipe network. If rate of change of flow is not known, certain throttle valves must be operated very slowly to ensure that they do not cause an excessive rate of change in flow rate. If the flow through the valve could be measured by the operator, significant amounts of time could be saved.
- At present leak detection and pinpointing techniques are not able to distinguish between large leaks and small leaks. They may be targeted on metered areas with unexpectedly high levels of consumption, but within such an area it is common to find that one large leak accounts for the vast majority of the water loss, with many other small leaks, that are not economic to repair, having been repaired anyway because their size could not be determined in advance.

Isolating lengths of main in turn and monitoring the changes in the total amount of water entering the metered area can allow lengths of main with very large leaks to be identified, but if it were possible to measure the flow into each length of main by simply closing all possible feeds except one and then measuring the flow in through the one remaining valve, this would result in much increased confidence in the results, it would be much quicker and it would not cause inconvenience to customers.

It will be understood that the invention extends to retro-fittings i.e. to modification of an existing valve to provide flow data.

